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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/773,185	02/09/2004	Kia Silverbrook	MTB27US	8427

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SILVERBROOK RESEARCH PTY LTD
393 DARLING STREET
BALMAIN, 2041
AUSTRALIA

EXAMINER	
FIDLER, SHELBY LEE	
ART UNIT	**PAPER NUMBER**
2861	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/773,185	SILVERBROOK, KIA	
	Examiner	Art Unit	
	Shelby Fidler	2861	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 April 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-6,8-25 and 27-54* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6,8-25 and 27-54* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *3/19/2007 & 5/2/2007*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 4/17/2007 has been entered.

Information Disclosure Statement

The information disclosure statement (IDS) submitted on 5/2/2007 is being considered by the examiner.

Claim Objections

Claims 4 and 22 recite the limitations "the serpentine form" and "the electrodes," and "the second gap." There is no antecedent basis for these limitations in the claim.

Claims 12 and 31 are objected to because of the following informalities: please change "each element" in line 1 of the claims, to "each heater element" to correct a minor antecedent basis problem. Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-2, 5-6, 11-13, 15, 18-20, 23-25, 30-32, 34, 37-38, 42-43, 47-48, 50-51, and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mitani et al. (US 5831648) in view of Kubby (US 5851412).

Regarding claims 1 and 19:

Mitani et al. disclose an ink jet printhead comprising:

a plurality of nozzles (nozzles 312);

a bubble forming chamber (individual ink channels 309) corresponding to each of the nozzles respectively (Fig. 31);

at least one heater element (heater 303) disposed in each of the bubble forming chambers respectively (Fig. 32A), wherein the heater element is configured for thermal contact with a bubble forming liquid such that,

heating the heater element to a temperature above the boiling point of the bubble forming liquid forms a gas bubble that causes the ejection of a drop of an ejectable liquid through the nozzle corresponding to that heater element (col. 3, lines 1-32); wherein,

the heater element is an elongate strip (heater 303 is elongate, since the thickness dimension is much smaller than the length dimension), the strip having a cross section with a lateral dimension at least triple that of the thickness of the strip, the thickness of the strip being less than 0.3 microns (col. 24, lines 25-28 show that the heaters have a thickness of 0.2 microns, and col. 24, lines 1-2 show that the heaters have a width of 50 microns).

Mitani et al. do not expressly disclose that the heater element is suspended.

However, Kubby discloses a heater element (e.g. doped region 22) that is suspended (col. 4, lines 5-10).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a suspended heater element, such as taught by Kubby, into the invention of Mitani et al. The motivation for doing so, as taught by Kubby, is to allow ink to flow on both sides of the heater element so that heat is dissipated from the heater element to the ink more efficiently (col. 2, lines 4-24).

Regarding claims 2 and 20:

Mitani et al. also disclose that the gas bubble is formed on an axis which extends through the center of the nozzle (col. 25, lines 55-60 and Fig. 33A).

Regarding claims 5, 24, and 42:

Mitani et al. also disclose that the bubble forming liquid and the ejectable liquid are of a common body of liquid (col. 25, lines 51-61).

Regarding claims 6, 25, and 43:

Mitani et al. also disclose that the printhead is configured to print on a page and to be a page-width printhead (col. 30, lines 53-55).

Regarding claims 11, 30, and 47:

Mitani et al. also disclose that the heater element has two opposite sides (Fig. 32A) and is configured such that the gas bubble formed by that heater element is formed at both sides of the heater element (col. 25, lines 55-60).

Regarding claims 12, 31, and 48:

Mitani et al. also disclose that the heater element is configured such that the point of collapse of a bubble formed thereby is spaced from that heater element (col. 24, lines 31-40 and

Fig. 31 show that an oxidized film is formed on the resistor which prevents any ink or bubbles from touching the heater).

Regarding claims 13, 32, and 50:

Mitani et al. also disclose a structure (nozzle plate 311) with nozzles (nozzles 312) incorporated thereon (col. 23, lines 41-42).

Examiner notes the additional limitation that the structure is formed by CVD. However, the method of forming a device is not germane to the issue of patentability of the device itself. Therefore, this limitation has not been given patentable weight.

Regarding claims 15, 34, and 51:

Mitani et al. as modified by Kubby disclose all the limitations of claim 1, and **Kubby also discloses** a plurality of bubble forming chambers (cavities 16), each corresponding to a respective nozzle (Fig. 5), and a plurality of heater elements (doped regions 20) are disposed in each chamber (Figs. 4 and 5), the heater elements within each chamber being formed on different respective layers to one another (col. 4, lines 45-65 and Fig. 3).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a plurality of heater elements formed on different layers, such as taught by Kubby, into the invention of Mitani et al. as modified by Kubby. The motivation for doing so, as taught by Kubby, is to dissipate heat both upwards and downwards (col. 5, lines 5-7).

Regarding claims 18, 37, and 54:

Mitani et al. as modified by Kubby disclose all the limitations of claim 1, and **Kubby also discloses** covering a heater element with a conformal protective coating (tantalum protective layer), the coating of each heater element having been substantially applied to all sides of the heater element such that the coating is seamless (col. 4, lines 54-65 and Fig. 4).

Examiner notes the additional limitation that the coating is applied to all sides simultaneously. However, this limitation relates to the method of forming a device, which is not germane to the issue of patentability of the device itself. Therefore, this limitation has not been given patentable weight.

Regarding claim 23:

Mitani et al. also disclose that the bubble forming liquid is in thermal contact with each of the heater elements, and that the ejectable liquid is supported adjacent each nozzle (col. 25, lines 55-61).

Regarding claim 38:

Mitani et al. as modified by Kubby disclose all the limitations of claim 1 that apply to claim 38, and **Mitani et al. also disclose** the steps of supplying the nozzle with a replacement volume of the liquid equivalent to the ejected drop (col. 4, lines 38-67); and

forming the gas bubble on an axis which extends through the center of the nozzle (col. 25, lines 55-60 and Fig. 33A).

Claims 3, 21, and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mitani et al. as modified by Kubby, as applied to claims 1, 19, and 38 above, and further in view of Campbell et al. (US 4870433).

Regarding claims 3, 21, and 39:

Mitani et al. as modified by Kubby expressly disclose all claimed limitations except that the bubble forming chamber has a circular cross section.

However, Campbell et al. disclose a bubble forming chamber (cavity 21) that has a circular cross section (Figs. 1 and 2).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a bubble forming chamber that has a circular cross section, such as disclosed by Campbell et al., into the invention of Mitani et al. as modified by Kubby. The motivation for doing so, as taught by Campbell et al., is to hold a predetermined amount of ink between the heater element and the nozzle (col. 3, lines 3-7).

Claims 4, 22, and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mitani et al. as modified by Kubby, as applied to claims 1, 19, and 38 above, and further in view of Lee et al. (6460961 B2).

Regarding claims 4, 22, and 40:

Mitani et al. as modified by Kubby disclose all claimed limitations except that the heater element has a double omega shape wherein a first omega shape extends between electrodes and a second omega shape is inverted relative to the first and extends between a gap that is in the first omega shape.

However, Lee et al. disclose a heater element (heating element 120") that has a double omega shape (Fig. 5), wherein a first omega shape (outer annulus of heating element 120') extends between electrodes (Fig. 5), and a second omega shape (inner annulus of heating element 102') is inverted relative to the first and extends between a which is in the first omega shape (Fig. 5).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize the heating element of Lee et al. into the invention of Mitani et al. as modified by Kubby. The motivation for doing so, as taught by Lee et al., is to produce a bubble ink and causing ink drops to be ejected (col. 1, lines 25-32).

Claims 8, 10, 27, 29, 44, and 46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mitani et al. as modified by Kubby, as applied to claims 1, 19, and 38 above, and further in view of Silverbrook (US 6019457).

Regarding claims 8, 27, and 44:

Mitani et al. as modified by Kubby disclose all claimed limitations except that each heater element is configured such that an actuation energy of less than 500 nanojoules is required to be applied to that heater element to heat that heater element sufficiently to form a bubble in the bubble forming liquid thereby to cause the ejection of a drop.

However, Silverbrook discloses that each heater element is configured such that an actuation energy of less than 500 nanojoules is required to be applied to that heater element to heat that heater element sufficiently to form a bubble in the bubble forming liquid thereby to cause the ejection of a drop (col. 19, lines 8-10).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize heater elements configured to actuate with less than 500 nanojoules of energy, such as taught by Silverbrook, into the invention of Mitani et al. as modified by Kubby. The motivation for doing so, as taught by Silverbrook, is to allow power dissipation to be reduced (col. 19, lines 8-10).

Regarding claims 10, 29, and 46:

Mitani et al. as modified by Kubby disclose all claimed limitations except that the substrate having a substrate surface, wherein the areal density of the nozzles relative to the substrate surface exceeds 10,000 nozzles per square centimeter of substrate surface.

However, Silverbrook also discloses a substrate having a substrate surface, wherein the areal density of the nozzles relative to the substrate surface exceeds 10,000 nozzles per square centimeter of substrate surface (using the reference measurement of Figure 43 and counting the individual nozzles disclosed in the "part of cyan" section of Figure 43, calculations show that the density exceeds 10,000 per square cm: $\frac{20 nozzles}{0.0016384 cm^2} = 12207 \frac{nozzles}{cm^2}$).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a high nozzle density, such as taught by Silverbrook, into the invention of Mitani et al. as modified by Kubby. The motivation for doing so, as taught by Silverbrook, is to provide four nozzles per pixel (col. 16, lines 60-63)..

Claims 9, 28, and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mitani et al. as modified by Kubby, as applied to claims 1, 19, and 38 above, and further in view of Otsuka et al. (US 5485179).

Regarding claims 9, 28, and 45:

Mitani et al. as modified by Kubby disclose all claimed limitations except that the heater element is configured such that the energy required to be applied thereto to heat the heater element to cause the ejection of a drop is less than the energy required to heat a volume of the ejectable liquid equal to the volume of the drop, from a temperature equal to the ambient temperature to the boiling point.

However, Otsuka et al. disclose a heater element is configured such that the energy required to be applied thereto to heat the heater element to cause the ejection of a drop is less than the energy required to heat a volume of the ejectable liquid equal to the volume of the

drop, from a temperature equal to the ambient temperature to the boiling point (col. 13, lines 21-28 shows that the energy required to heat the heater is less when the ambient temperature is high, and more when the ambient temperature is low; therefore, Otsuka teaches that it would take less energy to eject a drop of ink than it would to heat ink from an ambient temperature to a boiling temperature).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize Otsuka's heating configuration into the invention of Mitani et al. as modified by Kubby. The motivation for doing so, as taught by Otsuka, is to control the temperature of the recording head based on the present ambient temperature (col. 12, lines 41-49).

Claims 14, 33, and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mitani et al. as modified by Kubby, as applied to claims 1, 19, and 38 above, and further in view of Rausch et al. (US 6857727 B1).

Regarding claims 14, 33, and 49:

Mitani et al. also disclose that the printhead comprises a structure (nozzle plate 311) on which nozzles (nozzles 312) are incorporated (col. 23, lines 41-42).

Mitani et al. as modified by Kubby do not expressly disclose that the structure is less than 10 microns thick.

However, Rausch et al. disclose a printhead (printhead assembly 12) comprising a nozzle plate (orifice plate 60) that is about 10 microns thick (col. 5, lines 44-47 and col. 6, lines 8-11).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize the nozzle plate structure of Rausch et al. into the invention of Mitani et al. as modified by Kubby. The motivation for doing so, as taught by Rausch et al., is to provide more consistent and uniform formation of orifices (col. 7, lines 11-18).

Claims 16, 35, and 52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mitani et al. as modified by Kubby, as applied to claims 1, 19, and 38 above, and further in view of Chan (US 5870121).

Regarding claims 16, 35, and 52:

Mitani et al. as modified by Kubby disclose all claimed limitations except that each heater element is formed of solid material more than 90% of which, by atomic proportion, is constituted by at least one periodic element having an atomic number below 50.

However, Chan discloses heater elements (resistive layers 26 and 27) that are formed of solid material, more than 90% of which, by atomic proportion, is constituted by at least one periodic element having an atomic number below 50 (Ti and TiN; col. 5, lines 11-22).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a heater element formed of more than 90% Titanium, such as taught by Chan, into the invention of Mitani et al. as modified by Kubby. The motivation for doing so, as taught by Chan, is to take advantage of TiN's highly stable and highly resistive characteristics (col. 5, lines 11-22).

Claims 17, 36, and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mitani et al. as modified by Kubby, as applied to claims 1, 19, and 38 above, and further in view of DeMoor et al.

Regarding claims 17, 36, and 53:

Mitani et al. also disclose that each heater element (303) is a solid material () and is configured to be heated to a temperature above the boiling point thereby to heat the part of the bubble forming liquid to a temperature above the boiling point to cause the ejection of a drop ().

Mitani et al. as modified by Kubby do not expressly disclose the heater element is less than 10 nanograms.

However, DeMoor et al. disclose a heater element is less than 10 nanograms (page 285, Fabrication: Ti thickness = 5nm; TiN thickness = 30nm; heater width = 2000μm; heater width = 0.4μm. Therefore, the volume of Ti within the heater is $4*10^{-12}$ cm^3, and the volume of TiN within the heater is $2.4*10^{-11}$ cm^3. Using the known densities of Ti = 4.54 g/cm^3 and TiN = 5.22 g/cm^3, the heater element has an entire mass of 0.14344 ng).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize De Moor et al.'s heater element mass into the invention of Mitani et al. as modified by Kubby. The motivation for doing so, as taught by De Moor et al., is that these heaters show excellent resistivity uniformity and a low TCR value (page 293, Conclusions).

Response to Arguments

Applicant's arguments with respect to claims 1, 19, and 38 have been considered but are moot in view of the new ground(s) of rejection. Please see the above combination that is based on the disclosures of Mitani et al. and Kubby. This combination discloses a heater element

comprising a suspended elongate strip, wherein the thickness of the strip is less than 0.3 microns.

Communication with the USPTO

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shelby Fidler whose telephone number is (571) 272-8455. The examiner can normally be reached on M-F 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Luu can be reached on (571) 272-7663. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Shelby 2. Fidler 6/11/2007

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